

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE
in its capacity as elected Office

Date of mailing (day/month/year) 13 June 2001 (13.06.01)	
International application No. PCT/IB99/01668	Applicant's or agent's file reference PAT 99313*PC
International filing date (day/month/year) 29 September 1999 (29.09.99)	Priority date (day/month/year)
Applicant HOLMA, Harri	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

10 February 2001 (10.02.01)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Pascal Piriou

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the

INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

☐ COMP RECORD

☐ FILE RECORD

☐ DIARY

23 JAN 2002

☐ RENEWAL RECORD

☐ CITATIONS

☐ INV AWARD

☐ LETTERS

☐ CC

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

(PCT Rule 71.1)

To:

HIBBERT, Juliet
Nokia IPR Dept.
Nokia House
Summit Avenue
Hampshire GU14 0NG
GRANDE BRETAGNE

Date of mailing
(day/month/year)

17.01.2002

Applicant's or agent's file reference

PAT 99313*PC

IMPORTANT NOTIFICATION

International application No.

PCT/IB99/01668

International filing date (day/month/year)

29/09/1999

Priority date (day/month/year)

29/09/1999

Applicant

NOKIA MOBILE PHONES LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



European Patent Office
D-80298 Munich
Tel +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer

Teschauer, B

Tel.+49 89 2399-8231



PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PAT 99313*PC	FOR FURTHER ACTION		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/IB99/01668	International filing date (<i>day/month/year</i>) 29/09/1999	Priority date (<i>day/month/year</i>) 29/09/1999	
International Patent Classification (IPC) or national classification and IPC H04B1/707			
Applicant NOKIA MOBILE PHONES LIMITED et al.			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 8 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 10/02/2001	Date of completion of this report 17.01.2002
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Staeger, R Telephone No. +49 89 2399 8124 

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB99/01668

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):
Description, pages:

1-12 as originally filed

Claims, No.:

1-14 as originally filed

Drawings, sheets:

1/6-6/6 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB99/01668

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 11-14.

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 11 are so unclear that no meaningful opinion could be formed (*specify*):
see separate sheet

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for the said claims Nos. 12-14.

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)

Yes: Claims 1-9

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB99/01668

	No:	Claims	10
Inventive step (IS)	Yes:	Claims	6
	No:	Claims	1-5, 7-10
Industrial applicability (IA)	Yes:	Claims	1-14
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

III. No opinion

Claim 11 is considered as unclear, because there is neither a receiver as antecedent in claim 8 nor is claim 11 comprising any technical features of a mobile station which could be compared with prior art mobile stations.

Hence, for claim 11 it is impossible to indicate an opinion with regard to inventive step.

V. Reasoned statement with regard to novelty and inventive step:

1. Reference is made to the following documents:

D1: US-A-5 544 156 (EWERBRING LARS-MAGNUS ET AL) 6 August 1996

D2: GB-A-2 300 545 (MOTOROLA LTD) 6 November 1996

2a. According to PCT Guidelines C-III, 4.8 in the expression "decoder for ...; means for" (see claim 10) the word "for" is read as **"suitable for" and is therefore not necessarily limiting to the features following the wording "for"**. This has been taken into account when building an opinion about the novelty and inventive step of the claims.

b. Therefore, claim 10 is formulated in such a general manner that the features of said claim can be read from D1. In the following references to D1 will be indicated in brackets.

Document D1, in particular figures 1, 4 and 5, discloses as in claim 10:

A spread spectrum radio communication system (abstract), comprising:
a transmitter which transmits a data unit at one of a plurality of spreading factors over a data channel and transmits in parallel over a control channel a control unit comprising information for decoding said data unit (col. 3, l. 57-62; col. 4, l. 15-19, l. 29-31), and

a receiver (figure 1) comprising: a decoder (12, 26) for decoding (can be despread as in demodulator) an initial portion of the control unit (PCCH)(col. 4, l. 32-33);

a decoder (14 and 14 to decoder) suitable for decoding (can be despreading as in demodulator) an initial portion of the data unit at an assumed one of said plurality of spreading factors (col. 3, l. 63 to col. 4, l. 5); and means (16) suitable for calculating the received power of the initial portions of the control unit and the data unit, to make an estimate of the spreading factor used to transmit the data unit (figures 4 and 5, col. 5, l. 54 to col. 6, l. 2; col. 5, l. 37-38).

Therefore, the subject-matter as formulated in claim 10 does not seem to be novel (Article 33(2) PCT).

- c. Moreover, it is noted that even if novelty could be argued based minor differences, it appears that such differences would not involve an inventive step (Article 33(3) PCT), when having in mind the knowledge of the skilled person in the field of CDMA systems.

3. Claims 1 and 9:

- a. Although correspondent method claim 1 does not contain expressions like "suitable for", there can be raised equivalent objections on the basis of D1 for the remaining features.

Claim 1 merely differs in that claim 1 is explicitly claiming "decoding only an initial portion of control - and data unit". Claim 9 merely differs from claim 1 in the feature "to decode the whole of the data unit".

However, to decode either a whole unit or only a beginning portion of a unit, is merely a varying of the extend of decoding, which is considered as a routine design option for the skilled person in the field of radio receivers. Moreover, for accelerating a decoding process it seems to be obvious to bring the most important control information into the initial portion of a signal, thus to provide information for the decoding as fast as possible.

Thus, the subject-matter as formulated in claims 1 and 9 does not seem to be inventive (Article 33(3) PCT).

- 4a. Prima facie dependent claims 2-5 and 7-9 do not contain any features which, in

combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step, the reasons being as follows:

Claim 3-4: e.g. D1, col. 2, l. 39-59.

Claims 2, 5, 7-8 are considered as routine design options.

VII Certain defects in the international application:

1. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1-D2 is not mentioned in the description, nor are these documents identified therein.
2. Independent claims 10, 1 and 9 are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in a preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in a characterising part (Rule 6.3(b)(ii) PCT).
3. If necessary, the description should have been adapted to correctly reflect any changes in the scope of the claimed invention.
4. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

VIII Certain observations:

- 1a. Claims 1, 9 and 10 do not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The claims partly attempt to define the subject-matter in terms of the result to be achieved. In particular, in claim 1, l. 16-18, there is (in line 16) merely calculated the received power of the initial portion of control unit and data unit. However, the next step as claimed is merely indicating the result to be achieved (to make an estimate of the spreading factor used to transmit the data unit), which merely amounts to a statement of the underlying problem. The technical features necessary for

achieving this result should be added. With regard to description p. 9, l. 29- p. 10, l. 7 or to **claim 6**, there seems to be indicated which features are necessary to come from the calculated received power of control and data unit to the estimation of the spreading factors.

At present it is left completely open and unclear in said claims, how the spreading factors can be estimated when having merely the calculated received power of control- and data unit.

- b. Moreover, claims 1, 9 and 10 are not supported by the description as required by Article 6 PCT, as their scope is broader than justified by the description and drawings. The reasons therefor are the following:

According to claim 1, lines 16-18, on the basis of having calculated the received power of the initial portion of control unit and data unit, the estimation of the spreading factors could be done in a lot of different ways, which are not mentioned.

However, the description p. 9, l. 29 to p. 10, l. 10 convey the impression that this estimation can only be carried out in a particular way, namely by the features as indicated in said section of the description or as indicated in claim 6, and no alternative means are envisaged.

2. Apparently, in the description the text of p. 2, l. 14 to p. 3, l. 4 is by accident occurring twice (see also p. 3, l. 4-25).

PCT REQUEST

Original (for SUBMISSION) - printed on 28.09.1999 04:11:33 PM

0	For receiving Office use only	
0-1	International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and "PCT International Application"	
0-4	Form - PCT/RO/101 PCT Request	
0-4-1	Prepared using	PCT-EASY Version 2.84 (updated 01.07.1999)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	International Bureau of the World Intellectual Property Organization (RO/IB)
0-7	Applicant's or agent's file reference	PAT 99313*PC
I	Title of invention	SPREAD SPECTRUM COMMUNICATION SYSTEM
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	NOKIA MOBILE PHONES LIMITED
II-5	Address:	KEILALAHDENTIE 4 FIN-02150 ESPOO Finland
II-6	State of nationality	FI
II-7	State of residence	FI
II-8	Telephone No.	+358 24 3061
II-9	Facsimile No.	+358 24 30 64544>
III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	HOLMA, Harri
III-1-5	Address:	ITATUULELKUJI 1 D 32 FIN-02100 ESPOO Finland
III-1-6	State of nationality	FI
III-1-7	State of residence	FI

PCT REQUEST

PAT 99313*PC

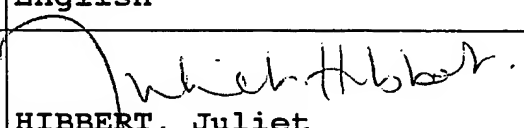
Original (for SUBMISSION) - printed on 28.09.1999 04:11:33 PM

IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name (LAST, First)	HIBBERT, Juliet
IV-1-2	Address:	NOKIA IPR DEPARTMENT NOKIA HOUSE SUMMIT AVENUE FARNBOROUGH, Hampshire GU14 ONG United Kingdom
IV-1-3	Telephone No.	+44 1252 865000
IV-1-4	Facsimile No.	+44 1252 865080
IV-1-5	e-mail	juliet.hibbert@nokia.com
IV-2	Additional agent(s)	additional agent(s) with same address as first named agent
IV-2-1	Name(s)	HAWS, Helen; JEFFERY, Kendra; HIGGIN, Paul; FRAIN, Timothy; MUIR, Henry
V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW SD SL SZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AL AM AT AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ DE DK DM EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW

PCT REQUEST

PAT 99313*PC

Original (for SUBMISSION) - printed on 28.09.1999 04:11:33 PM

V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI	Priority claim	NONE
VII-1	International Searching Authority Chosen	European Patent Office (EPO) (ISA/EP)
VIII	Check list	number of sheets electronic file(s) attached
VIII-1	Request	4 -
VIII-2	Description	12 -
VIII-3	Claims	3 -
VIII-4	Abstract	1 abstract93313.txt
VIII-5	Drawings	6 -
VIII-7	TOTAL	26
	Accompanying items	paper document(s) attached electronic file(s) attached
VIII-8	Fee calculation sheet	✓ -
VIII-16	PCT-EASY diskette	- diskette
VIII-18	Figure of the drawings which should accompany the abstract	2
VIII-19	Language of filing of the international application	English
IX-1	Signature of applicant or agent	
IX-1-1	Name (LAST, First)	HIBBERT, Juliet

FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/EP
10-6	Transmittal of search copy delayed until search fee is paid	

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference PAT 99313*PC	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/IB 99/ 01668	International filing date (day/month/year) 29/09/1999	(Earliest) Priority Date (day/month/year)
Applicant NOKIA MOBILE PHONES LIMITED et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

2

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 99/01668

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 12-14
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
Claims 12-14 rely entirely on the figures contrary to the requirement of the Regulations Under the PCT, Rule 6.2 (a).

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 12-14

Claims 12-14 rely entirely on the figures contrary to the requirement of the Regulations Under the PCT, Rule 6.2 (a).

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 99/01668

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B1/707

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 300 545 A (MOTOROLA LTD) 6 November 1996 (1996-11-06) page 3, line 30 -page 5, line 29; figures 1-3 ----	1,9,10
A	US 5 544 156 A (EWERBRING LARS-MAGNUS ET AL) 6 August 1996 (1996-08-06) column 3, line 49 -column 4, line 44 ----	1,9,10
A	GB 2 301 999 A (OKI ELECTRIC IND CO LTD) 18 December 1996 (1996-12-18) page 8, line 5 -page 12, line 21; figures 2,3 ----	1,9,10
A	WO 96 36132 A (NOKIA MOBILE PHONES LTD ;NOKIA TELECOMMUNICATIONS OY (FI); PEHKONE) 14 November 1996 (1996-11-14) page 12, line 7 - line 25; figure 4 -----	1,9,10



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

G document member of the same patent family

Date of the actual completion of the international search

30 May 2000

Date of mailing of the international search report

07.06.2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
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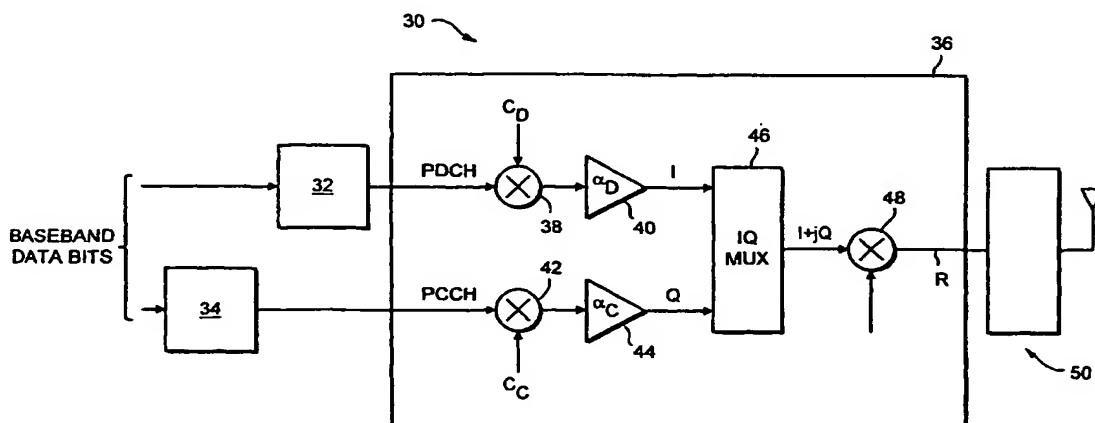
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(54) Title: SPREAD SPECTRUM COMMUNICATION SYSTEM



(57) Abstract: This invention is concerned with the situation where communication between a base station and a mobile station take place over a multirate data channel having a corresponding control channel which is (i) transmitted in parallel with the data channel and which (ii) needs to be adequately decoded to extract control information in order to properly decode the data channel. The invention provides a method of and a system for estimating the spreading factor of data in a channel in a spread spectrum radio communication system comprising a transmitter and a receiver, wherein the transmitter transmits a data unit at one of a plurality of spreading factors over a data channel and transmits in parallel over a control channel a control unit comprising information for decoding said data unit, the method comprising the steps of: decoding an initial portion of the control unit; decoding an initial portion of the data unit at an assumed one of said plurality of spreading factors; and calculating the received power of the initial portions of the control unit and the data unit to make an estimate of the spreading factor used to transmit the data unit.

SPREAD SPECTRUM COMMUNICATION SYSTEM

- 5 The present invention relates generally to a spread spectrum communication system, and more specifically, to spreading factor estimation in a spread spectrum communication system.

10 In a spread spectrum system, a modulation technique is used which spreads the information signal over a wide frequency band within the communication channel. The frequency band is much wider than the minimum bandwidth required to carry the information signal. For example, if the information signal is a voice signal, it may have a bandwidth of only a few kilohertz but, during transmission, its energy could be spread so as to be transmitted over a
15 channel 5 MHz wide. This is accomplished by modulating the information signal with a wideband encoding signal. The information signal is then recovered by remapping the received spread spectrum into its original bandwidth.

- 20 Spread spectrum systems can be multiple access communication systems. One type is a code division multiple access (CDMA) system. In a CDMA system, users of the system can simultaneously use the same wideband physical communication channel (for example, the same 5MHz part of the spectrum) with the signals between one group/pair of users being
25 differentiated from that of another by a unique spreading code.

The present invention is a particularly applicable to a cellular system. A highly schematic cellular architecture is shown in Figure 1. The system comprises a plurality of macrocell base stations 10 (only an exemplary 10a, 10b, 10c being
30 shown) providing service within a corresponding macrocell 12 (only an

exemplary 12a, 12b, 12c being shown). The system also comprises a plurality of mobile stations 14 (only an exemplary 14a and 14b are shown in the macrocell 10a). Each base station 10 communicates with the mobile stations 14 on a CDMA channels at a frequency F1 and a bandwidth of 5
5 MHz, the communication channel (s) carried out between a base station 10 and a mobile station 14 in its service area being defined by at least one unique spreading code.

The present invention is concerned with the situation where communication
10 between a base station and a mobile station take place over a multirate data channel having a corresponding control channel which is (i) transmitted in parallel with the data channel and which (ii) needs to be adequately decoded to extract control information in order to properly decode the data channel. This situation is illustrated in Figure 1 in the downlink direction between the
15 base station 10a and the mobile station 14a. The data channel is labelled DPDCH and the control channel is labelled DPCCH is labelled.

According to one aspect the present invention may provide a method of estimating the spreading factor of data in a channel in a spread spectrum
20 radio communication system comprising a transmitter and a receiver, wherein the transmitter transmits a data unit at one of a plurality of spreading factors over a data channel and transmits in parallel over a control channel a control unit comprising information for decoding said data unit,

25 the method comprising the steps of:

decoding an initial portion of the control unit;

decoding an initial portion of the data unit at an assumed one of said plurality
30 of spreading factors; and

calculating the received power of the initial portions of the control unit and the data unit to make an estimate of the spreading factor used to transmit the data unit. This situation is illustrated in Figure 1 in the downlink direction
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decoding an initial portion of the control unit;

decoding an initial portion of the data unit at an assumed one of said plurality
20 of spreading factors; and

calculating the received power of the initial portions of the control unit and the data unit to make an estimate of the spreading factor used to transmit the data unit.
25

By estimating the correct spreading factor used to transmit the data unit based only an initial portion of the control unit and the data unit, the data unit can thereafter be properly decoded. Provision for the buffering of a whole data unit need not be made. It is also an advantage that, for the control
30 channel, the transmission power need not be so high nor coding so powerful,

because said information for decoding the data unit is not the only indicator of the spreading factor used to transmit the data unit.

- The data in the data unit and the control unit is preferably interleaved. The length of the data unit and the control unit corresponds to the interleaving interval. For example, when the data is interleaved over one system frame, the control unit and the data unit each occupy one system frame. Moreover, when data is interleaved over a number of frames, the control unit and the data unit occupy that number of frames. In this case, because the spreading factor is constant over an interleaving interval, when the second and subsequent frames of a data unit are transmitted their spreading factor is already known. In one embodiment, the said initial portion of the data unit can comprise one system frame.
- 15 Preferably, the lowest of the possible spreading factors is used to decode the initial portion of the data unit. By using this spreading factor, even if the data was actually transmitted with a higher spreading factor, the integrity of the data remains in tact even if it is poorly noise filtered.
- 20 According to another aspect, the present invention may provide a spread spectrum radio communication system, comprising a transmitter which transmits a data unit at one of a plurality of spreading factors over a data channel and transmits in parallel over a control channel a control unit comprising information for decoding said data unit, and a receiver comprising
- 25 a decoder for decoding an initial portion of the control unit, a decoder for decoding an initial portion of the data unit at an assumed one of said plurality of spreading factors; and means for calculating the received power of the initial portions of the control unit and the data unit to make an estimate of the spreading factor used to transmit the data unit.

The present invention can be applied to especially, but not exclusively, to W_CDMA uplink.

5 In the context of the present invention, the term 'estimating the spreading factor' is used. It will be appreciated by those skilled in the art that by determining the spread factor (essentially a layer 1) quantity, the bit rate of data coming from layer is also, in effect, being determined, the bit rate being a straightforward and known function of the amount of repetition applied by the channel coding.

10

Exemplary embodiments of the invention are hereinafter described with reference to the accompanying drawings, in which:

15 Figure 1 shows a diagram of a cellular system useful for explaining the present invention;

Figure 2 shows a diagram of a mobile station transmitter architecture;

20 Figure 3 shows a diagram of a base station receiver architecture;

Figure 4 shows the frame structure of the DPCCH and DPDCH from an air interface perspective;

25 Figures 5(a-c) show the signal constellations for the receiver of Figure 3 with the DPDCH channel transmitting at three different power levels/spreading factors; and

Figure 6 shows the frames shown in Figure 4 from a user service perspective.

30

Referring back to Figure 1, in order for the base stations 10 to communicate with the mobile stations or radiotelephones 14, that is to set up, release and maintain connections therebetween, a number of functions need to be achieved over the air in both the uplink and the downlink. These functions are
5 carried out by means of logical channels.

Generically, the basic functions to be carried out are (i) *synchronisation*, where the mobile station locks onto the timing of a base station, enabling it to decode other channels; (ii) *broadcast*, where, for the purposes of initialisation,
10 the mobile station decodes system and cell specific information e.g. cell identities, spreading codes, access channel and neighbouring cells lists; (iii) *random access*, where the mobile station can initiate a service request; (iv) *paging*, whereby an incoming service can be directed to the mobile station; (v) *dedicated channel control*, necessary for carrying signalling information such
15 as handover measurements, service adaptation information, and power control information; (vi) *traffic*, necessary for carrying a wide variety of user-service data. Thus, generally logical channels exist corresponding to each of the functions (i) to (vi).

20 These basic functions can be mapped into physical channels, wherein the precise choice of how the logical channel are mapped into the physical channels will be highly system dependant.

In the system of the illustrated embodiment, the downlink comprises three
25 common channels: a primary and a secondary common control physical channel (CCPCH), and a synchronisation channel (SCH) (function (i) above). The downlink also includes dedicated physical data channels (DPDCH) (function (vi) above) and physical control channel (DPCCH) (function (v) above). The primary CCPCH incorporates the point to multipoint broadcast
30 control channel (BCCH) (function (ii) above). The secondary CCPCH

comprises a forward access channel (FACH) and a paging channel (PCH) (function (iv) above). The FACH is used for carrying control information to a mobile station when the network knows the location cell of the mobile station.

- 5 The uplink comprises one common channel, the random access channel (function (iii) above). The uplink also includes dedicated physical data channels (DPDCH) (function (vi) above) and physical control channel (DPCCH) (function (v) above).
- 10 When a mobile station, say 14a, is first powered up it initialises and registers with the network using the SCH to acquire synchronisation to the strongest base station, which in this case is 14a. Once synchronisation has occurred the mobile station 14a detects the CCPCH, reading the system and cell specific BCCH information. From the BCCH, the mobile station 14a acquires
- 15 codes permitting it to make a call request with the network. After initialisation, the mobile station enters idle mode and waits to be paged by an incoming service, for example, by an incoming call, or for the user to request a service, for example place an outgoing call.
- 20 Services for the user are provided using the previously mentioned DPDCH and the DPCCH. Each of these physical channel consists of 10ms frames, each frame comprising 15 slots. In one mode, services are provided with the frames operating in a mode hereinafter referred to as the multirate mode. In this mode, the PDCH carries the user-service data at a data rate which is
- 25 constant within a single frame, but may vary from frame to frame. The DPCCH carries control information necessary to decode the DPDCH. Specifically, each frame of the DPCCH includes a transport format indication TFI which carries information indicating the data rate of the corresponding frame of the DPDCH. The DPCCH also carries power control symbols, pilot

symbols and service parameter information for the corresponding frame of the DPDCH.. The DPCCH is transmitted at constant data rate.

Figure 2 shows the transmitter 30 architecture of a mobile station for transmitting data on these two physical channels. The base station comprises a DPDCH baseband processor 32 for baseband processing data for transmission on the DPDCH, and a DPCCH baseband processor 34 for baseband processing data for transmission on the DPCCH. Each baseband processor 32, 34 is operable to provide the conventional baseband processing operations, including, for example, convolution coding, turbo coding, puncturing/repetition and interleaving.

The data from each baseband processor 32, 34 is fed to a spreading modulation element 36. Within the spreading modulation element 36, the data for the DPDCH is spread by PN code C_d in a spreading element 38 and scaled by a factor A_d in scaling element 40 to give a signal I , and the data for DPDCH is spread by PN code C_c in spreading element 42 and scaled in scaling unit 44 by a factor A_c to give a signal Q . The codes C_d and C_c are orthogonal variable spreading factor codes. The signals I , Q are then fed to a quadrature modulator (QPSK) 46 to produce a signal $I + jQ$. This signal is then spread again by a PN scrambling code C_{scramb} in spreading element 48 which is a complex user-specific scrambling code to give signal R . The codes C_d and C_c are for channelisation.

The multiplexed and spread signal R is then upconverted to the frequency F , power amplified and transmitted by RF section 50.

Figure 3 shows the receiver 60 architecture for the receiver of the base station.

The receiver 60 comprises an RF section 80 for demodulating the received signals into the I,Q parts. A power estimator unit provides an estimate of the power of I and Q and feeds this information to a baseband processing unit 65. As described below in more detail below, the baseband processing unit of the receiver 60 is able to use the power estimates I and Q to calculate an estimate of the spreading factor/data rate.

The frame structure of the multirate mode is illustrated in Figure 4. 5 exemplary 10ms frames are shown, the DPCCH frames are labelled 101 to 105, and the corresponding DPDCH frames are labelled 201 to 205.

If Figure 4 is considered as a simple example of a uplink transmission, from the air interface (layer 1) perspective, the user data stream is transmitted on DPDCH as three data units. Data unit 1 is transmitted over frames 1 and 2 at the highest power, P1 (and hence lowest spreading factor); data unit 2 is transmitted over frames 3 and 4 at a lesser power, P2; and data unit 3 is transmitted over frame 5 only at the lowest power, P3 (and hence highest spreading factor). The data rate of the blocks is changed by changing the length of the spreading codes or using parallel spreading codes in the spreading modulation unit 36 or by puncturing/repetition in the DPDCH baseband processor 32. Because of the interleaving operation in the baseband processor 32, the user service data is interleaved over both frames 1 and 2 in block 1, over both frames 3 and 4 in block 2, and over only frame 5 in block 3. Similarly, the data stream in the DPCCH, notably the FCH, is interleaved over frames 1 and 2, frames 3 and 4, and frame 5, corresponding to the data units in the DPCCH. As explained above though, the transmission power on this channel is constant, P0.

The receiver 60 knows *a priori* the set of possible ratios of data channel receive power to control channel receive power. Expressed in other words, it

may be thought that the receiver 60 knows the set of absolute transmission powers/spreading factors, because the channel attenuation of the data channel and the control channel is approximately the same, the corresponding received powers are related to the corresponding transmission power by the same factor of proportionality. Hence, the set of possible ratios of data channel power to control channel power as transmitted are the same as the set possible of possible powers on reception.

Thus, in this way, the transmission power and hence the spreading factor can be estimated in principle. Figure 5(a-c) shows the signal constellations for received power is P_3' , P_2' and P_1' , respectively. It will be appreciated that because the control and data channels are subjected to varying degrees of attenuation, the magnitude of the signal constellations vectors varies, but because the attenuation is approximately the same, their angles remain the same.

Referring again to Figure 4, in order to estimate the relationship between the received power of the control channel and the data channel before the spreading factor used to transmit the data channel can be decoded from the control channel DPCCH, the data channel DPCDH signal is decoded assuming the lowest of the set of allowed spreading factors. With this assumption, the samples from the first 20 % or so of frame 1 of the data channel DPCDH are decoded and averaged to give a power estimate P_{da} . Over the same interval, the control channel DPCCH is also decoded at its known, fixed spreading factor. The samples decoded from each channel are squared and averaged to give an estimate P_{ca} . The ratio P_{da}/P_{ca} will correspond more closely to one of P_3'/P_0' , P_2'/P_0' or P_1'/P_0' and hence yield an estimate of the corresponding spreading factor. Once an estimate of the spreading factor is so obtained, decoding of the data channel begins at the estimated spreading factor and hence little buffering is needed. In this way,

both frames 1 and 2 are decoded. The process is then repeated for data unit 2, and subsequently for data unit 3.

It will be appreciated that as the number of frames in a data unit increases the advantage of not having to buffer the whole data unit to properly to decode the TFI becomes more and more significant.

Because communication between the base station 10a and the mobile station 14a takes place over a multirate data channel DPDCH having a corresponding control channel DPCCH which is transmitted in parallel and carries information about the data on the data channel, this channel architecture can be exploited advantageously in accordance with the described preferred embodiment of the invention to flexibly bundle a variety of user services into the data channel according to the priority of the services and the current data rate supportable by the data channel. For example, if there are four sets of user service data which need to be transmitted, say services 1 to 4 and, for convenience of explanation, the priority of the services is also in numerical order (whereby service 1 is the highest priority and service 4 is the lowest priority), then these services could be transmitted in accordance with the preferred embodiment of the invention as shown in Figure 6. In Figure 6, the same data units 1 to 3 of Figure 4 are considered from a user services perspective. In data unit 1, transmitted with the power P_1 , where the spreading factor is the lowest and hence the data rate the highest, all services 1 to 4 are being transmitted.. In data unit 2, which is at a lower power P_1 and lower data rate, only higher priority services 1 and 2 are transmitted. In data unit 3, which is at the lowest power P_2 and lowest data rate (highest spreading factor), only the highest priority service 1 is transmitted. Although for diagrammatic simplicity the services are shown in consecutive, separate time segments, in practice, each service is evenly interleaved over the respective data unit.

In other embodiments, the whole data unit can be decoded before estimation of the data rate/ spreading factor because this may lead to better estimation.

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10

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CLAIMS

1. A method of estimating the spreading factor of data in a channel in a spread spectrum radio communication system comprising a transmitter and a receiver, wherein the transmitter transmits a data unit at one of a plurality of spreading factors over a data channel and transmits in parallel over a control channel a control unit comprising information for decoding said data unit,
- the method comprising the steps of:
- decoding an initial portion of the control unit;
- decoding an initial portion of the data unit at an assumed one of said plurality of spreading factors; and
- calculating the received power of the initial portions of the control unit and the data unit to make an estimate of the spreading factor used to transmit the data unit.
2. A method as in Claim 1, wherein data in the control unit and the data unit is interleaved over the duration of the respective units.
3. A method as in Claim 2, wherein the data unit comprises a single frame.
4. A method as in Claim 2, wherein the data unit comprises a plurality of frames.
5. A method as in any preceding claim, wherein the assumed spreading factor is the lowest of said plurality of spreading factors.

6. A method as in any preceding claim, wherein said estimate is calculated by matching the relationship between the received powers of the control unit and the data unit with a member of a set of possible power
5 relationships known *a priori*, wherein each member of the set corresponds to one of said spreading factors.

7. A method as in any preceding claim, wherein, after having made said estimate, the rest of the data unit is decoded using the said estimate of the
10 spreading code.

8. A method as in any preceding claim, wherein a said data unit comprises data relating to a plurality of user services.

15 9. A method of estimating the spreading factor of data in a channel in a spread spectrum radio communication system comprising a transmitter and a receiver, wherein the transmitter transmits a data unit at one of a plurality of spreading factors over a data channel and transmits in parallel over a control channel a control unit comprising information for decoding said data unit,
20

the method comprising the steps of:

decoding an initial portion of the control unit;

25 decoding the whole of the data unit at an assumed one of said plurality of spreading factors; and

calculating the received power of the initial portions of the control unit and the data unit to make an estimate of the spreading factor used to transmit the
30 data unit.

10. A spread spectrum radio communication system, comprising :

5 a transmitter which transmits a data unit at one of a plurality of spreading factors over a data channel and transmits in parallel over a control channel a control unit comprising information for decoding said data unit, and

10 a receiver comprising a decoder for decoding an initial portion of the control unit, a decoder for decoding an initial portion of the data unit at an assumed one of said plurality of spreading factors; and means for calculating the received power of the initial portions of the control unit and the data unit to make an estimate of the spreading factor used to transmit the data unit.

11. A mobile station including a receiver as defined in Claim 8.

15

12. A method of estimating the spreading factor of data in a channel in a spread spectrum radio communication system substantially as hereindescribed with reference to the accompanying drawings.

20 13. A spread spectrum radio communication system constructed, arranged and adapted to operate substantially as hereindescribed with reference to the accompanying drawings.

25 14. A mobile station for a spread spectrum communication system constructed, arranged and adapted to operate substantially as hereindescribed with reference to the accompanying drawings.

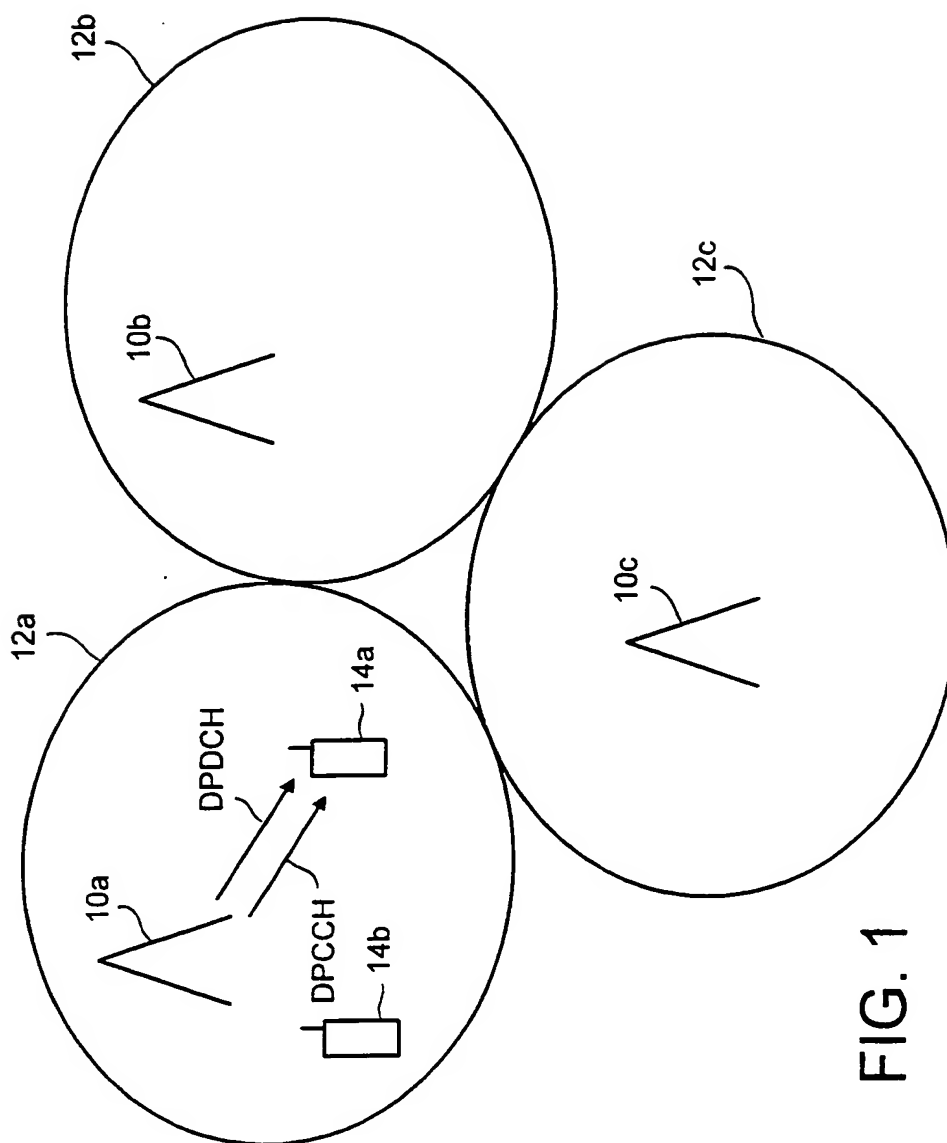
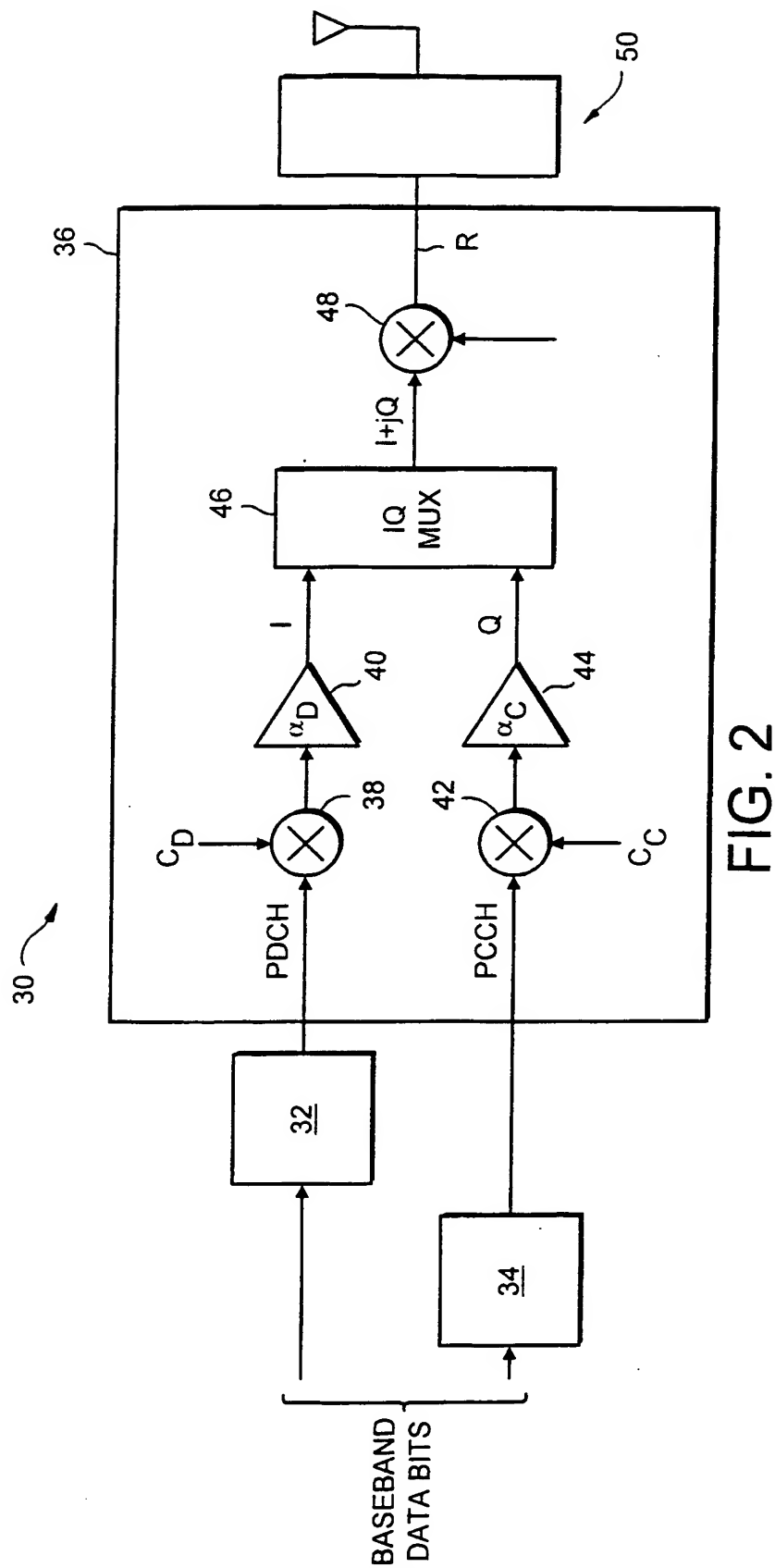
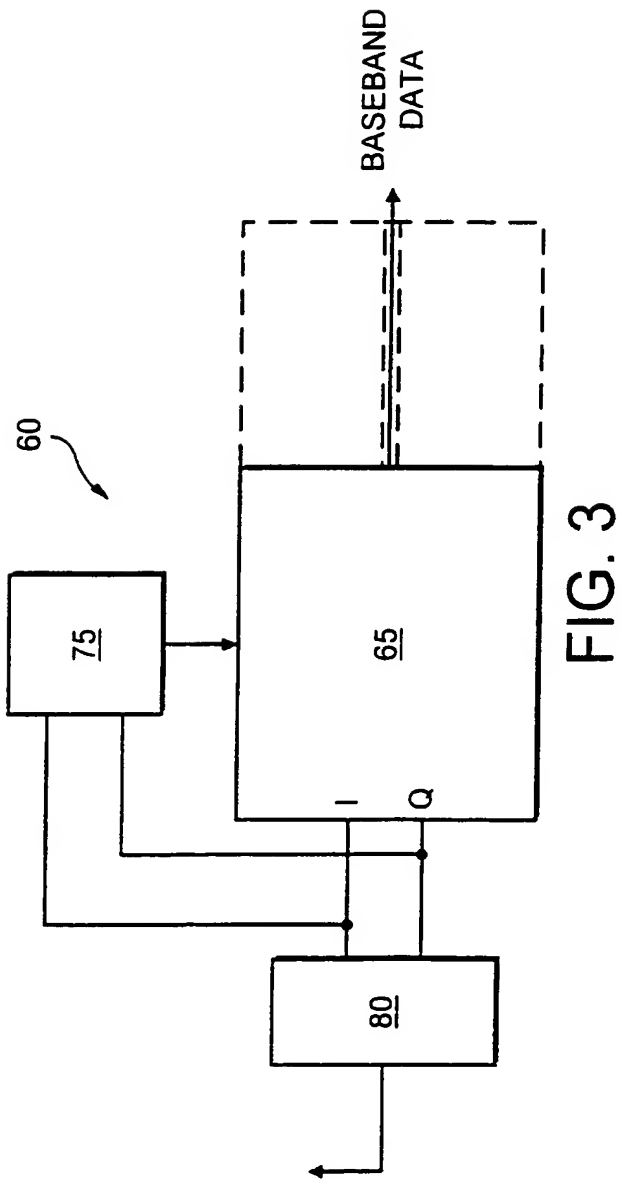


FIG. 1

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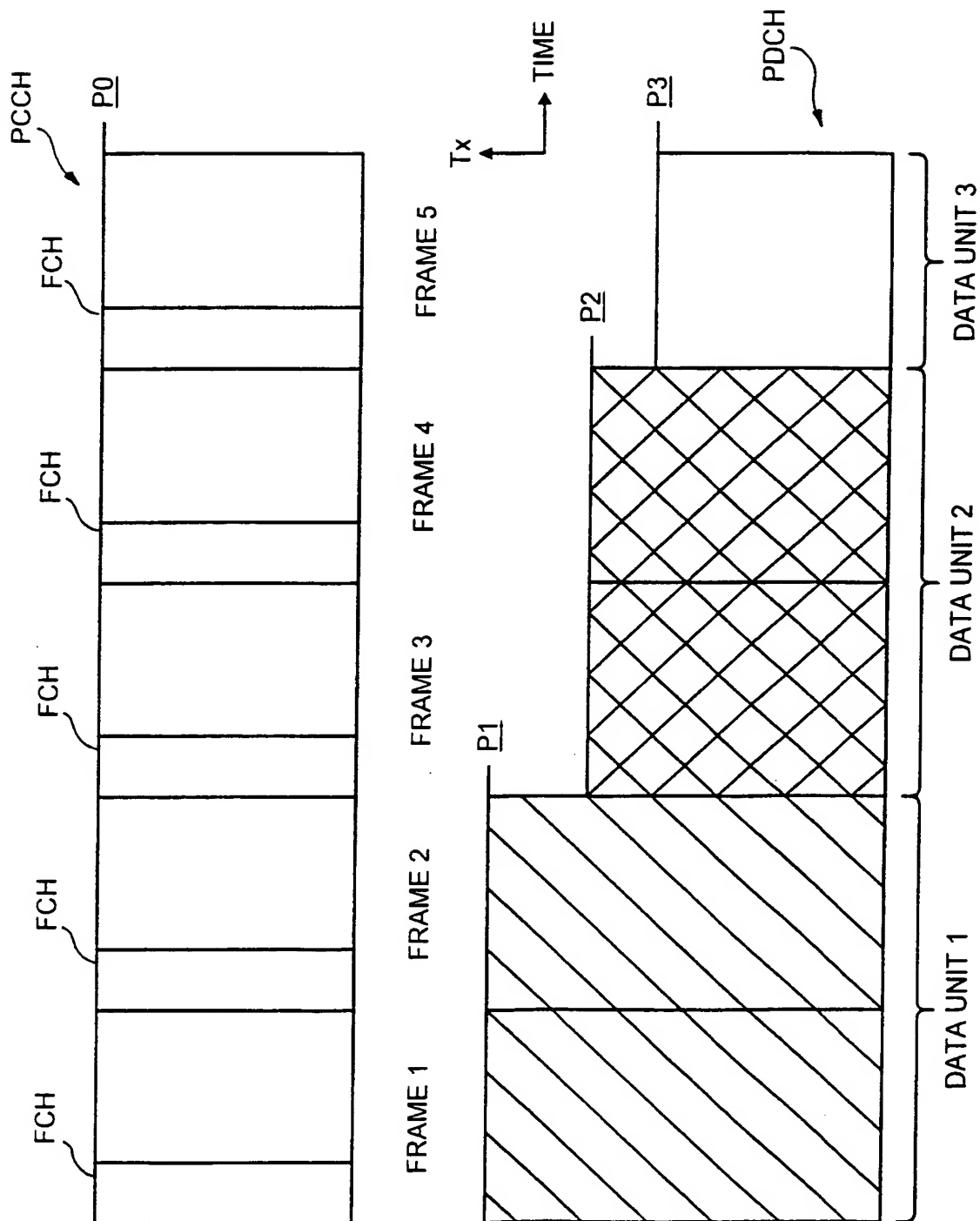


FIG. 4

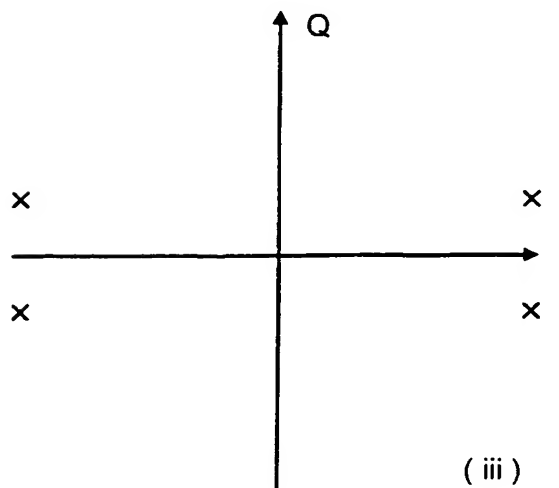
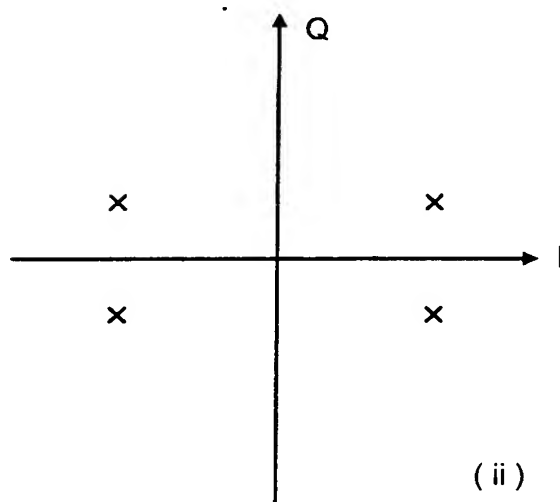
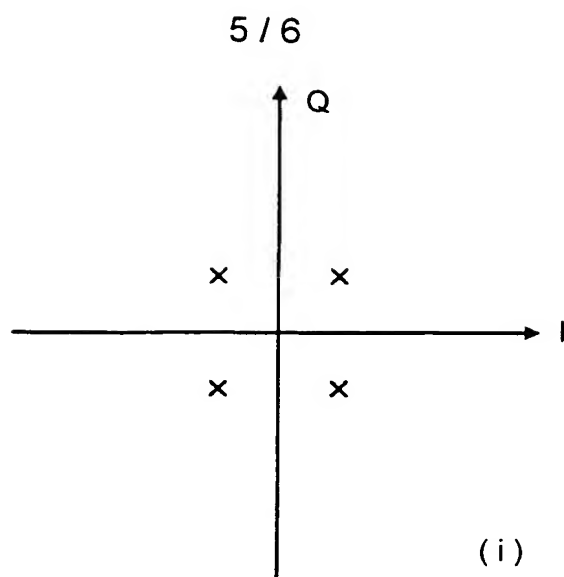


FIG. 5

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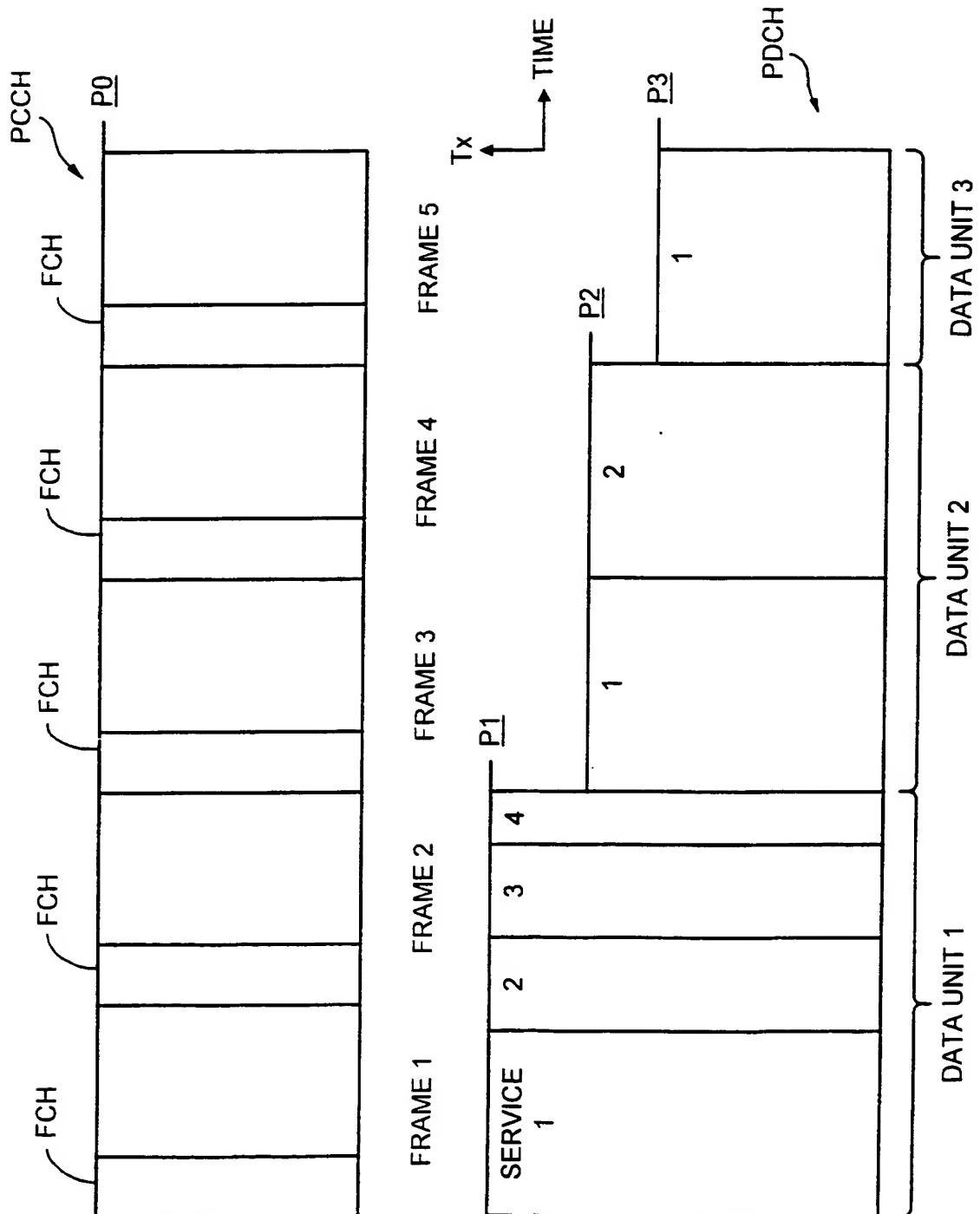


FIG. 6